Evaluation of a New 10-Minute Count Station and Small Lift Bucket at Tracy Fish Collection Facility

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Summary

This study will investigate a new 10-minute (min) count station and associated small lift bucket at the Tracy Fish Collection Facility (TFCF). The current fish collection procedure involves a 342.6-L (90.5 gal) lift bucket which is used to transport fish into a count bucket. Fish and debris are collected in a partial dewatering basin where facility operators net, measure, and count the fish collected during the 10-min sample. The current system has been in use for many years and recent concerns relating to ease of use, fish damage, and impact on salvage have arisen.

It is documented that fish collected in the holding tanks at the TFCF are subject to "abrasion by vegetative debris…, stress from high swirling velocities.., and putative harsh transfer due to high fish densities" (Portz 2007). Individually fish can manage these stresses, however when combined, these stressors have an increased chance to negatively impact fish survival rates. Fish collected in the holding tanks are concentrated into the lift bucket and transported to a stagnant count station where further dewatering occurs. Considering transportation of fish, Wedemeyer (2001) concluded that concentrating fish into a small volume without adequate aeration can cause death from hypoxia. Survival is greatly reduced when concentrated fish experience excessive debris, large temperature fluctuations, and over handling (Wedemeyer 2001).

Currently at TFCF the 10-min count exposes fish all the stressors that Wedemeyer concluded increases mortality including high fish concentrations, excessive debris, large temperature fluctuations, and over handling. This study will evaluate and develop new methods that can be implemented to improve the 10-min count at the TFCF. Research will be focused on determining the best methods to: reduce fish damage, accurately count fish quickly, improve the small lift bucket efficiency and use, improve the recovery of

handled fish, and develop a method to separate debris and fish during the counts. Feasibility level drawing and cost estimates will be produced to aid in future implementation.

Problem Statement

Several issues exist that prevent the current 10-min count from being a simple and easy process. One issue arises with the use of the small 342.6-L (90.5-gal) lift bucket. When the bucket is lowered into the holding tank a rubber fill valve is required to open to allow the bucket to fill with water. After the valve is opened the tank is lowered to a seat in the holding tank. At this point the fill valve is supposed to close, providing a tight seal which keeps the fish in the lift bucket. Unfortunately this fill valve rarely seals completely. Researching new ways to seal the lift bucket drain will reduce fish loss through the system.

Another issue with the current system is that debris and fish are both concentrated into a small volume of water to allow operators to count and measure the fish. This highly concentrated debris-filled volume traps fish and reduces the chance of survival after the count. Ongoing research is being conducted by Reclamation biologists to determine the amount of damage that occurs to fish that pass through the facility. Investigating new methods to remove debris without damaging fish will cause less stress on the fish and increase survival rates and counting accuracy.

After the fish are counted and measured they are thrown back into the holding tanks. At times returned fish free fall over 4.57 m (15 ft) before coming into contact with the water. This large drop, combined with other stressors like water temperature, further reduces the chance of survival. Researching new methods, including possible chilled short-term holding, for returning counted fish to the holding tanks would reduce casualties.

During the 10-min count it often becomes difficult to have several people participating at the same time because of space limitations. The small volume of water only allows for one individual to do the counting, thus causing longer counting time and in return higher levels of stress on the fish. Evaluating a 10-min count layout that would allow multiple operators to participate in the fish count would decrease exposure time.

Each count requires that the operators know what the fish look like so they can ensure an accurate count. Although identification guides are easily available at the count station, an advanced touch screen computer might be developed and incorporated into the Central Valley Automated Control System (CVACS) system to aid in the counting and recording process. This screen will allow operators to tap on a picture of each fish to count them. Developing such a touch screen will not be done under this project; however consideration will be made which will allow space for the screens for future addition to the new count station.

Goals and Hypothesis(ses)

Goals:

1. Can a new 10-min count station allow operators to perform their duties more accurately in less time?

2. Can a method be developed and implemented for inserting the 342.6-L (90.5-gal) small lift bucket that will ensure a tight seal and prevent fish loss?

3. Can a method be developed and implemented to remove debris from the 10-min count water and not damage or loose fish?

4. Would sending fish to intermediate chilled holding tanks increase survival rates when fish are returned to the system?

Hypotheses:

1. A newly designed 10-min count station will allow operators to collect and count fish more accurately in less time.

2. Implementation of the 342.6 L (90.5-gal) small lift bucket can be improved by changing the design and/or operation.

3. Mechanically removing debris from the 10-min count water can damage fish if it is not utilized correctly. Developing a method to mechanically remove debris without damaging fish will improve the count station.

4. Fish reentering the collection tanks are subject to high water temperatures in addition to and handling stress. By sending fish to intermediate chilled holding tanks, temperature stress is decrease before fish are returned to the collection tanks.

Materials and Methods

Phase 1: Count Station Review

To help fully understand that current count station, researchers will visit the TFCF and operate the 10-min counts for 1 d and document the procedure, problems, and possible solutions. In addition a literature review will commence to determine if any methods currently exist that will simplify and improve the 10-min count. During the literature review, researchers will investigate different materials, bucket shapes, and valve options that will allow better operations of the lift bucket used to get the fish into the count station.

Phase 2: Prototype Development and Laboratory Testing

During Phase 2, researchers will evaluate methods for de-watering, removing debris and counting fish found during Phase 1. In addition to ideas found during Phase 1, any other methods that are developed by the researchers will be evaluated. Dewatering can be accomplished through screens, grates, or overflows. Removing debris may occur during the count or before counting begins by screening, manual removal, or automatic mechanical means. Methods for operation of the lift buck will be tested on a prototype lift bucket if necessary. Throughout the prototype development, space limitations, ease of use, and returning fish to the holding tanks will be considered. Physical modeling will include trial runs involving fish, debris, and any transportation devices proposed.

Feasibility level drawings and cost estimates will be created for the most efficient count stations.

Phase 3: Field Implementation and Demonstration Testing

Phase 3 will consist of a meeting to discuss the results of Phase 2. During the meeting TFCF engineers, managers, biologist and operators will be able to provide input as to which count station would be of most benefit. Field implementation and demonstration testing of the most favorable design will commence. Followup evaluations of the 10-min count performance will be scheduled to ensure that the implementation meets the needs of all involved parties.

Coordination and Collaboration

The study will be completed with strong coordination between TFCF operators, Reclamation biologists, fisheries, and engineering staff. Constant communication between all parties will ensure that needs are met. Findings will be presented to the Tracy Technical Advisory Team (TTAT) at a future agency meeting.

Endangered Species Concerns

The first phase of this work will not require special permits. When field testing of the count station is to commence, research engineers will coordinate with TFCF staff to acquire the necessary permits relating to influenced endangered species.

Dissemination of Results (Deliverables and Outcomes)

Progress reports will be issued during the end of each fiscal year stating the findings, future goals, feasibility level drawings, and cost estimates for relevant information. At the conclusion of the project a Tracy Technical Report will be produced.

Literature Cited

Portz, D.E. 2007. *Fish-holding-associated stress in Sacramento River Chinook salmon (Oncorhynchus tshawytscha) at south Delta fish salvage operations: effects on plasma constituents, swimming performance, and predator avoidance.* Doctoral dissertation. University of California, Davis.

Wedemeyer, G.A. 2001. *Fish Hatchery Management,* Second edition. Bethesda, Maryland, American Fisheries Society.